cartilage thickness in clinical trials of knee OA. Articular cartilage thickness can now be measured directly from MR images. In this study we compare the abilities of the results of JSW and cartilage thickness to measure progression and identify rapid progressors in a subset of the OAI progression group. This study aimed to determine whether x-ray and MRI measurements made at a common central location in the medial compartment: (1) record similar rates of progression, and (2) correlate in their ranking of subjects according to amount of disease progression.
Methods: A group of 88 individuals were identified from the OAI progression group 0.B.1 and 1.B.1. The subjects chosen had K-L scores of 2 or 3; medial JSN greater than lateral JSN, and evidence of medial osteophytes. KneeAnalyzer software (Optasia Medical, Manchester, UK) was used to make semi-automated annotations of the radiographs. JSW was automatically calculated along a parameterised line bisecting the medial compartment, with its origin (x = 0) at the tip of the tibial spine and end (x = 1) at the outer medial edge of the joint. The central JSW (cJSW) was measured at x = 0.5 on this line. Calibration was made by automated location of Synaflexer beads within the image. Pairs of MR images were manually segmented using EndPoint software (Imorphics, Manchester, UK), using trained segmenters blinded as to time point, but not subject. A dense set of anatomically corresponded points was automatically identified on the femur and tibia bone surfaces, using a 3D appearance model, allowing measurements to be taken at corresponding anatomical locations on each image. Average thickness (ThCtAB) of the cartilage situated inside the meniscal window of the medial femur (wcMF) and the medial tibia (wMT) was calculated. The values for wcMF and wMT were added together to provide a measure of the average thickness of articular cartilage in the meniscal window (MF + MT).
Results: The average change in cJSW using the x-ray method was −0.25 mm, or −5.01% (SRM −0.46; and p-value 0.00006). The MRI method showed an average change for (MF + MT) of −0.1 mm, or −2.78% (SRM −0.39, p-value 0.00048). However, the correlation between the two measures was poor ($R^2 = 0.7412$). A Bland Altman plot showed that there was an average bias of 1.35 mm between the measures. 95% limits of agreement between the measures were 0.0588 to 2.651 (SD of 0.061). No correlation could be discerned when plotting the amounts of change measured for each subject by the two methods.
Conclusions: Both methods were able to show progression within this group, with good statistical significance. However, the methods identified different populations of 'rapid progressors'. Unlike MRI, which measures only the cartilage thickness, X-ray measurement of joint width is taken weight bearing, and will include other factors such as synovial fluid and the behavior of the menisci under load. It is unclear whether the two approaches quantify the same progression in pathology but with poor agreement, or are sensitive to different manifestations of the disease.

407 FEMOROACETABULAR IMPINGEMENT: STANDARD RADIOLOGY AND DELAYED GADOLINIUM ENHANCED MRI OF CARTILAGE (DGEMRIC)

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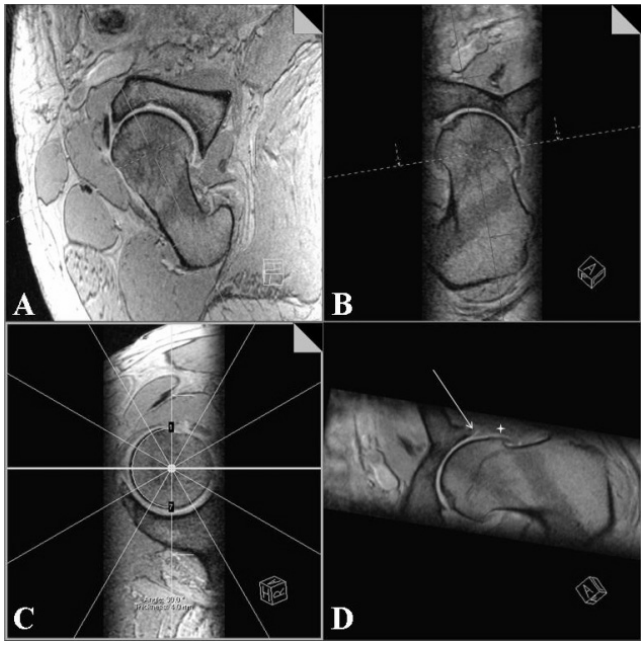
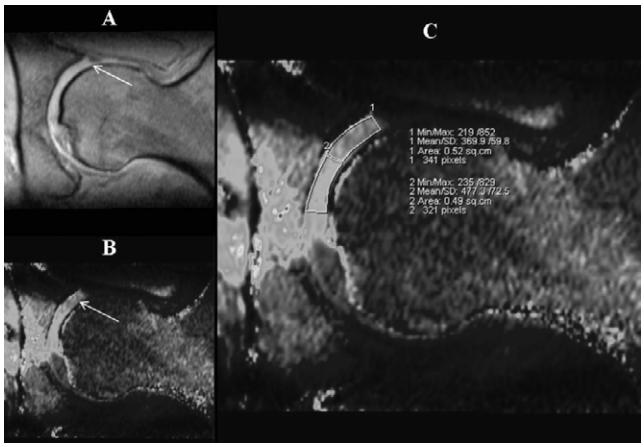
Purpose: With regard to anatomic abnormalities which can lead to premature osteoarthritis (OA) in the hip, mapping techniques e.g. dGEMRIC and T1 assessment additional to morphologic imaging may provide further information. Femoroacetabular impingement (FAI) is a pre-arthritic deformity in young patients arising from abnormal mechanic impact between the proximal femur and acetabulum due to a non-spherical shape of the femoral head (Cam-FAI) or mal-coverage by the acetabulum (Pincer-FAI). Aim of this study is to compare assessment of cartilage by delayed Gadolinium enhanced MRI of cartilage (dGEMRIC) between volunteers and FAI patients with different morphological parameters and stages of OA by using fast gradient echo (GRE) MRI at 1.5T.
Methods: 26 patients and 10 healthy volunteers were included. The FAI type was classified as cam, pincer or mixed type. Clinical and radiographic evaluation was performed. Prior MRI at 1.5T, gadolinium was intravenously administered. The protocol included: axial 2D turbo spin echo (TSE) (TR/TE = 491 ms/13 ms, 3 mm slice thickness, 160 mm FOV, 512×256 matrix), coronal oblique 2D TSE (TR/TE = 3060 ms/9.1 ms, 2 mm slice thickness, 130 mm FOV, 256×205 matrix), sagittal 2D TSE (TR/TE = 2900 ms/9.1 ms, 2 mm slice thickness, 130 mm FOV, 256×205 matrix), and radial 2D TSE (TR/TE = 1800 ms/13 ms, 4 mm slice thickness, 180 mm FOV, 512×256 matrix.) To obtain T1 mapping, a dual flip angle 3D GRE sequence was implemented: TR/TE/FA = 25 ms/3.6 ms/35º-10º, 0.78 mm slice thickness, 200 mm FOV, 256×256 matrix. By using multi-planar-reformat (MPR), 7 radial reformats concentric in the femoral head (Figure 1) were defined to evaluate morphology, femoroacetabular cartilage and labrum. 2 ROIs were drawn within each radial reformat and T1 times assessed (Figure 2). Continuous data are expressed as mean and standard deviation. Significant differences between patients and healthy control group were determined using the student's t-test. Correlation was performed using Pearson's linear regression. Reliability was determined in 10 patients.





Results: 14 cam-, 7 pincer-, and 5 mixed FAI patients were classified. The mean age was 30.1 years. In cam FAI, alpha angle and cartilage lesion extend was significantly larger from anterior to superior. In pincer FAI, cartilage degeneration was pronounced anterior and posterior. There were significantly more labral lesions in all FAI patients. Mean T1 values ranged from 616.1 ms (volunteers), 521.9 ms (cam FAI), 434.8 ms (pincer FAI), and 485.2 ms (mixed FAI.) In cam FAI, the lowest T1 values were at the anterior superior position. In pincer FAI, the lowest values occurred anterior and posterior. High negative correlation was found between morphologic anomaly and T1 values. Reliability was high in this study.
Conclusions: dGEMRIC and T1 mapping at 1.5T using fast GRE is feasible and can be beneficial to detect cartilage changes at an earlier stage of osteoarthritis in FAI. In accordance to morphologic findings there is a specific T1 pattern for FAI patients.